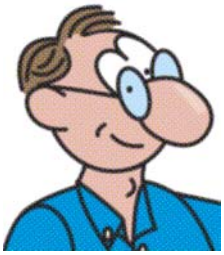
Paint by Pixels

One way to paint a picture is to put the brush on the paper and make strokes. There is another way to make pictures that you may not have tried. It uses only tiny points or dots of color. It does not mix colors together. If you look very close, you can see that each dot stands apart from its neighbors. This style of art is called "pointillism" (PWAN-tee-yiz-em). This word comes from French, because this type of art was invented in France in the 1800's.



Color pictures in newspapers (like the Sunday comics) are also made up of tiny dots. They have only four different colors: cyan (blue), magenta (red), yellow, and black. But, if you look at the pictures from a distance, all these colors blend together. Then your eyes and brain see other colors, such as pink, gray, brown, purple, and many other shades.

In this activity, you will paint a picture using this method. Your picture will be made up of dots. Another term for dot is pixel. "Pixel" is short for "picture element."

What to do:

You will need:

- Strong magnifying glass
- Several 4-color picture clippings from a newspaper
- Cotton swabs
- Tempera paint in red, yellow, blue, green, and black; plus shallow lids to pour paint into
- OR colored markers in red, yellow, blue, green, and black.
- 4 "paint-by-number" pages attached

Using the magnifying glass, look at a color picture from a newspaper. Notice that the picture is made up of tiny dots using only four different colors of ink.

Now, make your own "dot-matrix" picture. (In your picture, you can also use green.)

Each of the four pages attached makes up one part of a picture. If you are by yourself, you can paint all the parts of the picture yourself. Or, if you are in a group, share the fun with three other people. Each page is covered with squares. Most of the squares have a number from 1 through 5. Each number stands for a color:

1 = Red
2 = Blue
3 = Yellow
4 = Green
5 = Black (do these squares last)

Squares having no number are left white.

Put a dot or blob of the right color in each numbered square. You don't have to fill in the whole square, but make the dot or blob fill most of the square.

When you have filled in all the numbered squares, put your picture together with the three others. Trim the borders off the inside edges, if needed, and tape the four pages together. Put the "big picture" on the wall, and stand back. The dot-matrix pictures look very rough up close. What happens when you step back? Step further back?

This material was provided through the courtesy of the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.

Pixels from Space

Can you imagine making your four-page picture so big that it would cover thousands of pages like these, each with the same tiny squares? Imagine taping all those pages together. You could put the finished picture on a giant wall. It you stood far enough away to see the whole picture at once, you wouldn't be able to see the individual dots at all! It would look like a normal photograph.

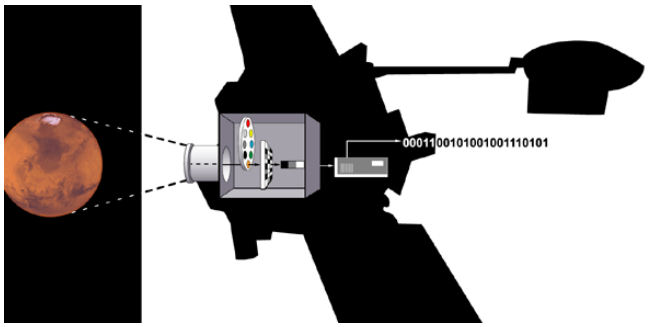
This is just how spacecraft cameras take pictures and store the information from each pixel (dot) as a number. This kind of data can then be sent through space to Earth.

How do pictures become numbers?

Instead of film, cameras on spacecraft have special electronic plates. Each plate is made up of hundreds of thousands (or millions) of tiny pixels. Light landing on a pixel causes it to become electrically charged.

When the camera takes a picture, each pixel that gets light becomes electrically charged. More light means more charge. A computer reads the charges on each pixel and assigns them numbers from 0 to 255, depending on how strong the charge is. No charge at all (meaning black, or no light) gets a 0. Very bright light (totally white) gets a 255. Everything in between gets a number based on how bright or dark the shade of gray. But what about colors?

For each color picture, several pictures are taken, each through a different colored filter. Each filter lets through only a certain color of light. For example, a red filter lets through only red light. So the red-filtered pixel data will show the brightness of the red colors in the scene. After computers on Earth combine the pixel data from three pictures, one taken through a red filter, one through a blue filter, and one through a green filter, we can see the original colors in the scene from space—and all from shades of gray!



It takes a lot of advanced technology and smart people here on Earth to do this long-distance photography. For one thing, giant dish-shaped antennas on Earth, like those of NASA's Deep Space Network, must receive the data from the spacecraft. The Deep Space Network is a system of these antennas grouped in three locations around the world. These antennas are so powerful they can detect the tiny whisper of a spacecraft millions or billions of miles out in space. It is this tiny whisper that carries the numbers that will be turned back into pictures of the wonders of space.

The Deep Space Network is managed and operated by the Jet Propulsion Laboratory for NASA.

Learn More

See and Explore Library: Space, Stars, Planets and Spacecraft by Sue Becklake et al., DK Publishing. ISBN 0789429667, May 1998.

DK Space Encyclopedia by Nigel Henbest and Heather Couper. DK Publishing. ISBN 0789447088, September 1999.

NASA's Deep Space Network web site: deepspace.jpl.nasa.gov/dsn

The Space Place web site: spaceplace.nasa.gov

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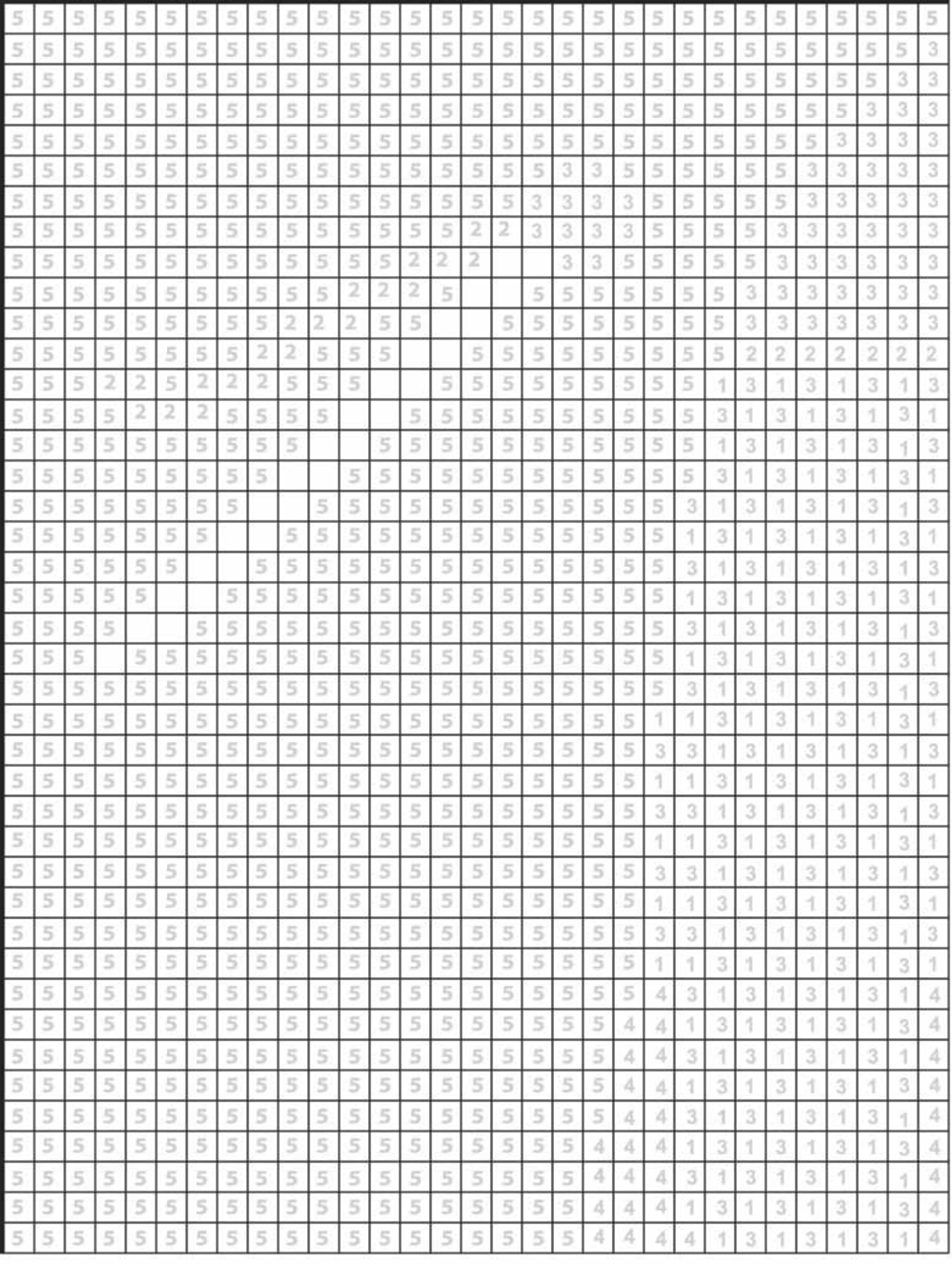

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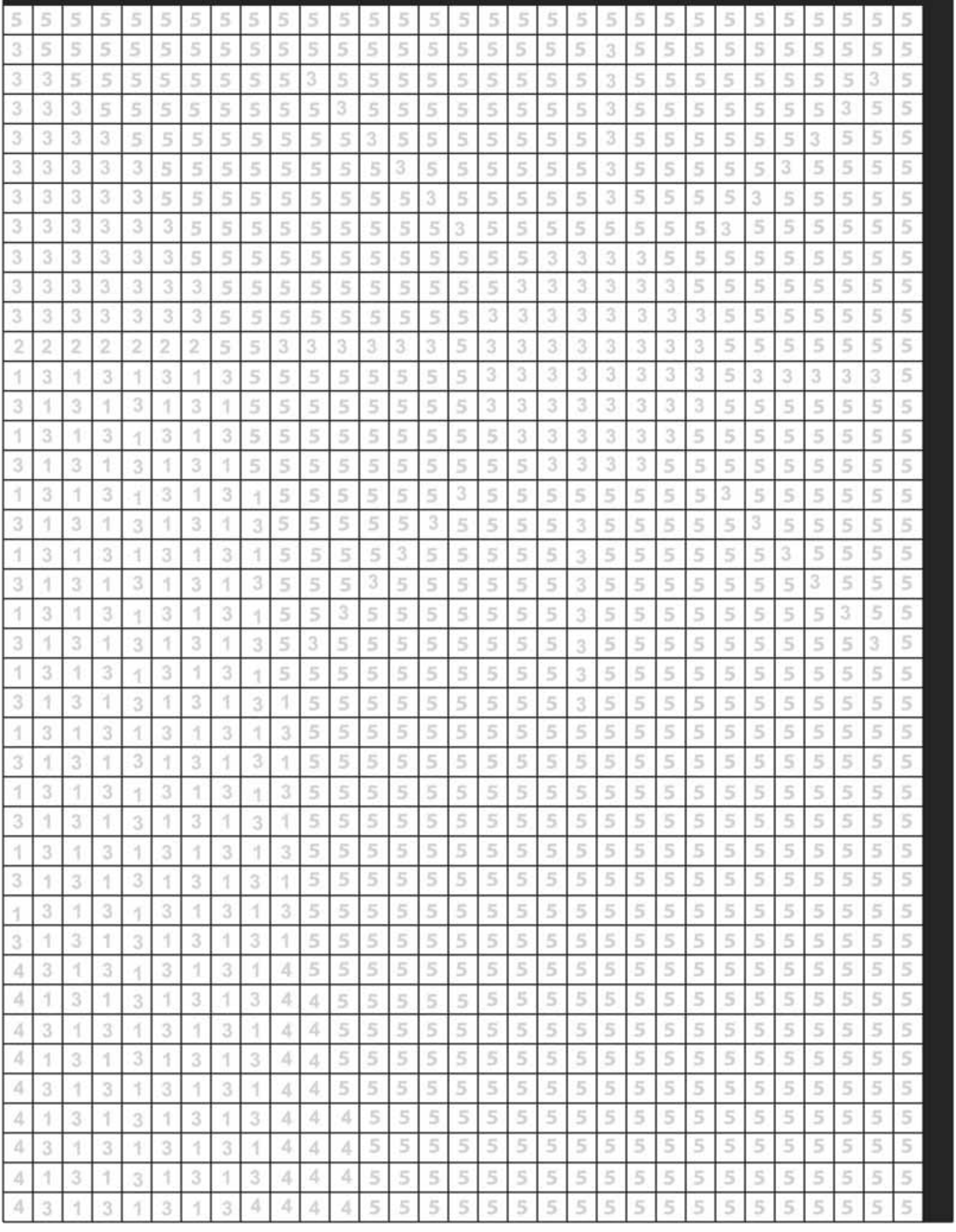

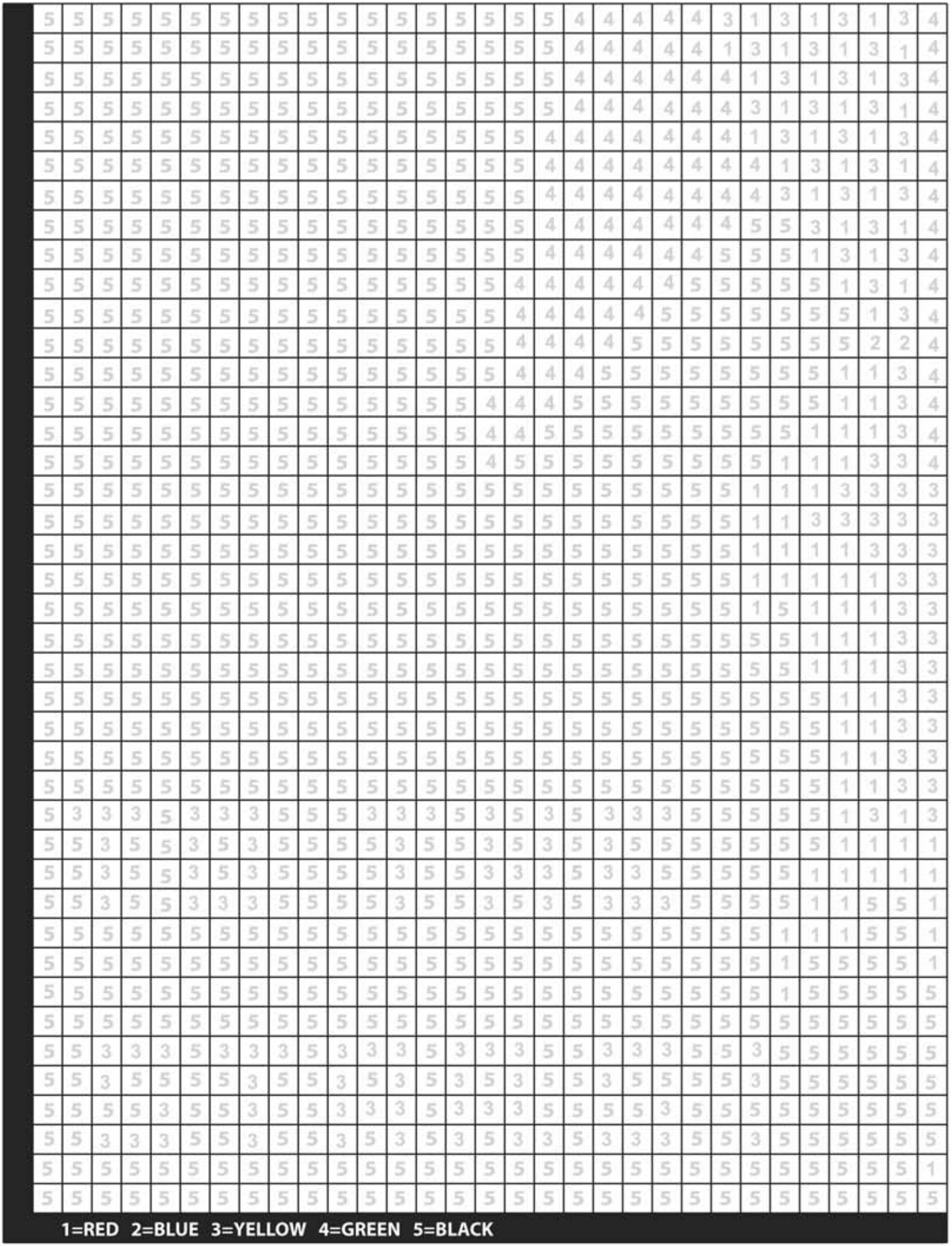

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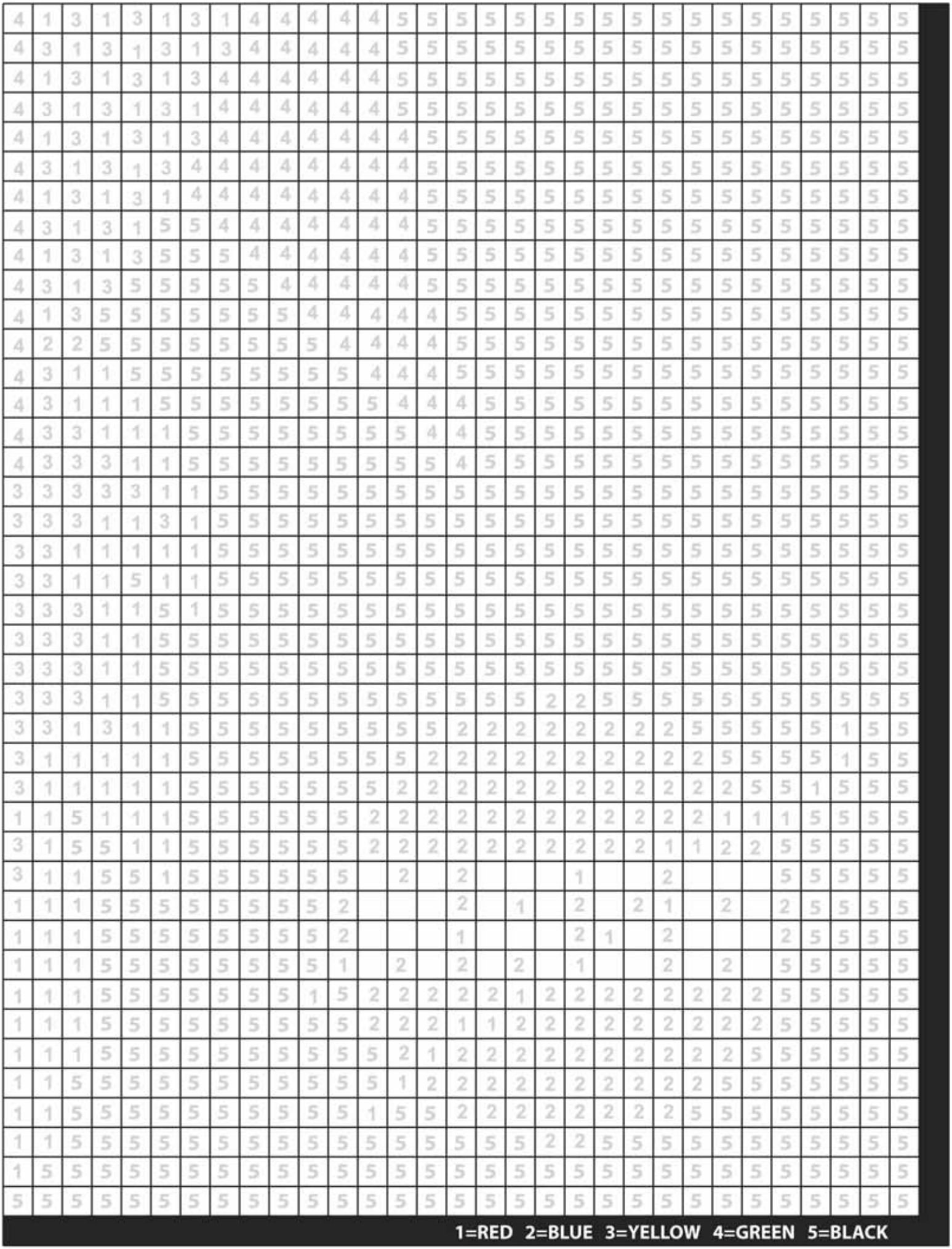
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Space Place
Press Release

Paint a Picture the NASA Way at Club Space Place

Spacecraft, such as Voyagers 1 and 2, Galileo, and Mars Global Surveyor, have sent back close-up images of other planets and moons in the solar system. Many of these images have been breathtaking in their detail and color, to say nothing of the strangeness of the worlds they have revealed. How do these spacecraft make these images? How do they turn them into signals that can be sent millions or billions of miles through space to be received and interpreted on Earth?

(*Name of Institution*) will host an art activity on (*Date*) at (*Time*). Children and their families will experience an image-making technique analogous to the technologies used by many of the imaging instruments on NASA spacecraft. Participants will enjoy working together on a picture, revealing its subject pixel-by-pixel, then putting all the pieces together in somewhat the same way NASA does when its Deep Space Network of huge antennas receives the spacecrafts' numerical data on the ground.

This activity is offered as part of *(Name of Institution)*'s participation in NASA's Space Place educational outreach program. The program is an exciting opportunity for children and adults to learn about space, Earth science, and the technologies used in space-based exploration of Earth and beyond. More information about the program and its educational activities can be found at http://spaceplace.nasa.gov.

Anyone interested in participating can contact *(Name)* at *(Telephone Number)* for more information about this program and other exciting Space Place activities.

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